Prevalence and factors associated with anxiety and depression in older adults: gender differences in psychosocial indicators

Prevalence and factors associated with anxiety and depression in older adults: gender differences in psychosocial indicators

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Abstract

Background: With increasing numbers of people living into old age, health functioning and good quality of life are central to public health policy in aging. However, quality of life for many elders is undermined by anxiety and depression. Understanding gender differences in the determinants of anxiety and depression symptoms is crucial to policy and practice.

Objective: To examine gender-specific symptom subtypes of later-life anxiety and depression, in relation to their socio-demographic, social and health context.

Method: Cross-sectional study using data from The Irish Longitudinal Study on Ageing (TILDA, 2009-2011). Latent class analysis defined gender-specific symptom profiles for anxiety and depression. Correlates of latent classes were analysed using logistic regression, assessing associations between socio-demographic factors; social indicators and health indicators.

Results: Four classes of self-reported anxiety and depression were derived: '*low'*, '*comorbidity'*, '*anxiety and subthreshold depression'* and '*anxiety'* only. With males 8% were comorbid, 26% subthreshold and 26% with anxiety only. With female 12% were comorbid, 27% subthreshold and 29% with anxiety only. While symptom expression may relate to stress from common ageing, our findings show clear gradations of symptoms associated with a range of social and health indicators.

Conclusion: Our findings support the actuality of *comorbid depression and anxiety* with further evidence for *anxiety and subthreshold depression*. A sizeable subgroup confirms that many older people experience *anxiety* only. Our study indicates the need for a more sensitive recognition of needs and a more nuanced policy agenda for older people towards improving the quality of their social life.

Introduction

With an aging population, the number of years spent in good health has considerable personal, social and economic benefits [1]. While both anxiety and depression may be adaptive physiological mechanisms for survival [2], dysfunction of related neural circuits through chronic stress or trauma can lead to pathological symptom expression [2]. In old-age psychiatry comorbid anxiety and depression is common: in up to 90% of patients with anxiety, symptoms of depression are also reported [3]. Combined, they are more persistent and intense [4] and associated with decreased quality of life, health impairment and mortality [5]. Lenze *et al* [6] and Lenze & Wetherell [7] note that distinguishing between later life adaptive or pathological symptoms is important, as symptoms can be misattributed as short-term adjustments to ageing. However, if left untreated, there is an increasing risk of medical and psychiatric illness [8]. Without appropriate diagnosis - undetected subthreshold symptoms, high levels of adaptive anxiety or dual diagnoses, older people may not receive adequate support or treatment [9]. Comorbid pathological disorders may have more severe psychological, physical and social impairment and, compared to adaptive emotions or isolated conditions, are more resistant to treatment and higher suicide risk [10].

Psychiatric comorbidity of anxiety and depression

Anxiety and depression may have similar biological mechanisms or share underlying symptoms. Previous studies suggest a temporal sequence between anxiety and subsequent depression [11]. Mediators indicated in the development of anxiety and depression include stressful life events, interpersonal dysfunction, behavioural avoidance and anxiety response styles [12].

In Ireland, the prevalence of major depressive disorder and generalized anxiety disorder among adults aged forty-five and above have been estimated at 10% and 5% respectively [13]. However, other international findings on the prevalence of co-morbid anxiety and depression vary considerable ranging from Beekman *et al*, in a Dutch study, showed that 13% of people with anxiety also met criteria for depression; a German study found 29.4% of respondents were comorbid; in a Canadian study 23% met criteria for anxiety and depression; and Porensky *et al* recorded 28.9% with depression

in an anxiety treatment-seeking sample. Similarly, with older populations diagnosed with depression - Beekman *et al* estimated that 47%–50% of individuals had comorbid anxiety disorder; and in a study of persons in primary care and psychiatric contexts Lenze *et al* found 23% also had an anxiety disorder [14-18].

While mixed anxiety–depression is generally considered the *typical* presentation in the elderly [18], more evidence is required. Comorbidity manifesting at sub-syndrome level can be both disabling, undertreated [19] and extensive, involved in almost half of all psychological problems and four-times more common than depression alone [20].

Diagnostic issues: adaptive or pathological symptoms

The expression and reporting of anxiety and depression symptoms may differ with age, making it imperative for DSM criteria to optimise diagnostic criteria, perhaps with the addition of descriptive features. The DSM-V Life Span Study Group proposes three approaches to age-related modification of diagnosis: revising the text section on *age-specific features* (for example, interactions between advancing age and comorbidity); providing age-sensitive examples of functional impairment alongside the diagnostic criteria; and age-related subtypes for situations where criteria differ by age for the same 'condition' (for example, irritability for childhood depression versus somatic symptoms for late-life depression) [1]. It may be that older adults and clinicians normalise feelings of fear, anxiety and avoidance, rendering the diagnostic process as less sensitive leaving subthreshold disorders often unrecognised [21]. Importantly, the emergence and expression of depression and anxiety symptoms and potential sub-types, may be rooted in a variety of social and personal experiences.

Social determinants of mental ill-health in older people

The importance of strong social relationships in promoting resilience and good mental health is increasingly recognised [22]. Loneliness (as opposed to social isolation) [23] is a perceived deficiency in one's personal or social relationships [24]. Loneliness is common in later-life marriages [25] and poor marital quality can exacerbate loneliness [24]. Marital quality has multiple dimensions where both

supportive and straining relations can coexist. Thus, it is important to examine relationship quality, not just the quantity of relationships, when assessing loneliness and mental health outcomes [24].

Social connection, health behaviours and medical outcomes

Loneliness is a strong predictor of depression and anxiety [26], negative health beliefs [27] and health outcomes. A meta-analytic review [28] reported substantial increases in survival for those with stronger social relationships. Social isolation is a risk factor for mortality, comparable to smoking, obesity, elevated blood pressure, and high cholesterol [29]. Social integration and good social networks are protective [30]. Multiple pathways account for the relationship between social participation and health [31], ranging from complex biological processes to practical activity, for example the influence of social ties on shaping health behaviours such as physical activity, smoking, alcohol use and accessing medical care [32].

Understanding the presentation of these disorders and their associated determinants has clinical significance for older adult populations. Consideration of symptom profiles and associations with a range of social and medical determinants will inform the use of psychosocial therapies and can guide pharmacological treatments to significantly improve quality of life for older patients.

Aims

To examine: (a) the prevalence of depression and anxiety among older community dwelling adults; and (b) to assess the socio-demographic characteristics associated with symptom profiles and associations with a range of social and medical indicators.

Sample, measures and methods

All data included was taken from Wave 1 of the TILDA study (2009-2011) [33]: a nationally representative community-based sample comprising 8,175 people aged fifty years or more and their spouses or partners, a proportion of whom were aged less than fifty (n=329, 3.9%).

Covariates: demographic characteristics were generally time-invariant and included age-group (50-59, 60-69, 70-79 and 80+) and educational attainment (primary, secondary and tertiary levels).

Measures of loneliness and extent of social networks: a measure of perceived loneliness was drawn directly from the TILDA questionnaire – four categories ranging from *none* to *lonely all the time*. These were summarised as never/hardly ever; some of the time; or often. The extent of social networks was quantified using the Berkman-Syme Social Network Index [32], which includes four components: (1) marital status - currently married/cohabiting; (2) close presence of children, relatives or friends - summarised as the presence of at least two of these; (3) membership of church groups - attendance at religious services at least once a month; and (4) membership of community organisations such as sports clubs, voluntary associations or charitable groups. These were accumulated and a summary social engagement indicator derived – isolated (0-1), moderately isolated (2), and integrated (3-4).

Spousal support or strain: relationship quality was measured using seven items describing spousal interactions, both positive and negative taken from the Perceived Social Support and Social Strain Scale [34]. The items comprising each scale were summed to provide separate indices of support and strain in inter-personal relationships and all items scored on a four-point scale (from 1=a lot (or often) to 4=not at all (or never)). Items were recoded so that higher scores indicated either higher support or strain, with zero noting those without a partner (indicating neither support nor strain).

Hearing difficulty: Self-assessed hearing problems and difficulties in following a conversation were obtained through a specific question: *can you follow a conversation with four people* – with responses - *No difficulty; Some difficulty; Much difficulty; No (cannot follow conversation).*

Limiting long-term illness (LLTI): comprises two questions: (1) *Do you have any long-term health problems, illness, disability or infirmity?* (yes/no); and (2) *Does this limit your activities in any way?* (yes/no).

CAGE questions for alcohol use - screens for excessive drinking and alcoholism: respondents completed the CAGE questionnaire - four questions evaluating alcohol use patterns and behaviour, and a valid screening assessment for alcoholism [35].

Smoking: During the CAPI interview, data were collected on smoking status and used to distinguish smoking history (never, past or current).

Hypertensive medication: Current use was recorded during the home-based interview and classified according to the World Health Organization Anatomical Therapeutic Chemical (ATC) classification system.

Depression: symptoms (experienced in the seven days preceding the survey) were assessed using the 20-item Centre for Epidemiologic Studies Depression (CES-D) questionnaire [36], listed in Table 2 - each scored from 0 (rarely/never) to 3 (five to seven days), accumulated generating a scale of increasing severity (0 to 60) and, using a standard cut-off of sixteen, recoded as a binary measure. Its validity in measuring depression in community-dwelling older adults is well-documented [37] and is reported to have 100% sensitivity and adequate specificity (88%) for assessing major depression [14].

Anxiety: symptoms were assessed using the anxiety subscale of the Hospital Anxiety and Depression Scale (HADS-A) [37], again listed in Table 2. As used here it comprises seven items, again scored from 0 (not at all) to 3 (very often). These were accumulated to generate a scale of increasing severity (0 to 21) and, using a cut-off of eight, recoded as binary. HADS-A is accepted as having good sensitivity, especially at older ages (89%) and adequate specificity (75%) [38].

Analyses

Fit indices were evaluated for Latent Class Analysis (LCA) models (Table 2) based on the depression and anxiety questions. Solutions for six classes were estimated, with *log-likelihoods*, *information criteria* (IC) and *classification accuracy* examined. To identify the best solution, we considered a combination of statistical criteria (ICs, and Lo-Mendell-Rubin: LMR), model parsimony, interpretability, meaningfulness and the need for theory and judgement. For both genders, a four-class solution provided the most parsimonious and theoretically meaningful solution - expressing

substantial subgroups for *subthreshold depression and anxiety*. Information statistics (Akaike information criteria- AIC; Bayesian information criteria- BIC; Sample size adjusted- SSABIC) were lower for the four-class, compared to the three-class solution. While in the five-class solution LMR was significant, interpretation of the four-class profile plot was more theoretically meaningful, indicating that five-classes or above was inferior. The entropy value was 0.77 (males) and 0.78 (females) in the four-class models, further indicated good latent classification.

Results

This analysis is based on 8,504 respondents aged fifty years or more, stratified by gender: 3,780 males and 4,724 females. Table 1 reports the gender-specific prevalence of symptoms of either depression or anxiety.

Figures 1 and 2 depict sample proportions and plot-estimated probabilities for each solution. The models, similar in distribution, distinguish clear patterns for symptom expression, based on: (1) *comorbid depression and anxiety* (with higher levels reported by females); (2) *anxiety and subthreshold* (or borderline) *depression*; (3) *anxiety only*; and (4) *no or low depression or anxiety*.

The sample comprised persons entering late adulthood (aged 50 plus years), with findings highlighting comorbid depression and anxiety as a significant concern. Both males (8%) and females (12%) report severe depressive and anxiety symptoms, with a further 26% of males 27% of females at risk, reporting anxiety and subthreshold depression. Anxiety only was recorded as 26% in males and 29% in females. In all models, comparisons were made with those recording low or no symptoms (32% of females and 40% of males).

Socio-demographic, social and health indicators

Tables 3 and 4 (males and females respectively), present three incrementally adjusted models examining the relationship between each derived level of comorbidity and contextual socio-demographic characteristics, social relationships and health outcomes.

Comorbid anxiety and depression [CAD]

Males (Table 3) and females (table 4) with CAD were similarly likely to be younger, with strained spousal relationships; for both, there was a distinct gradient effect for CAD at increasing levels of loneliness. Lower education increased the risk of CAD in females but had no significant affect for males. Males with hearing problems were more likely to have CAD but this was not the case for females. These associations for males and females remained after adjusting for health indicators (M2). While CAD was more likely among males and females with life-limiting illness (OR=2.44, 95%CI=1.75-3.41; OR=2.60, 1.92-3.54, respectively), it was associated with alcohol concerns in males only and current smoking status in females only.

Subthreshold depression [SD]

SD was more likely among males and females with relationship strain but negatively associated with spousal support for females only (OR=0.94, 95%CI=0.91—0.96). SD is also more likely among better educated males but the pattern is less consistent among females.

Age had little affect among males or females, although there was a slightly decreased risk in males aged 80 years or over. Similarly, good social networks are protective for men and females, but not significantly. The risk of SD increases with loneliness for both males and females, but more consistently so for females. The above factors altered little with the addition of health variables. Again, male SD is associated with hearing problems, current smoking and alcohol concerns. Life limiting illness is strongly associated with SD for both males and females (OR=1.35, 1.11, 1.64; OR=1.22, 1.02-1.46 respectively).

Anxiety only

Males with anxiety only were younger (50-59) and less educated; female anxiety was associated with a secondary school level education and with lower spousal support (OR=0.93, 95%CI=0.91-0.95) and higher relationship strain. However, males with *Anxiety only* report supportive spousal relationships (OR=1.08, 1.05-1.11) but greater relationship strain (OR=1.07, CI=1.04, 1.11). While, in both male

and female *Anxiety* subgroups, loneliness is less likely, good social networks appear to be maintained by females, but not males. Hypertension and alcohol concerns are associated with anxiety in males only.

Discussion

To our knowledge, this is the first study to examine symptom profiles of common mental disorders in older people in a large community-based sample and to explore gender differences for associated factors. Various age and gender patterns emerge from these data. First, all disorder symptoms appear to be most strongly associated with relatively younger people (50-59 years) possibly reflecting challenges within a transitional life-stage around retirement [39] [40] [41]. Our findings underpin the observation that retirement age is a potential risk factor for loneliness and poor mental health. Second, while a distinct association was noted between loneliness and depression (co-morbid or subthreshold), loneliness does not appear to affect people with anxiety, suggesting perhaps that anxiety has substantially less impact on social relationships than might be expected [35]. Moreover, the strongest association for male and female loneliness is among those with co-morbid depression and anxiety suggesting a gradient across the disorder subgroups. Third, while low spousal support and relationship strain were associated with mental-ill health, we found that females with anxiety, unlike their male counterparts, appear to maintain social networks which may be protective against loneliness and depression. It may be that females over the life-course have built wider, supportive networks than males, who may be overly dependent on smaller family connections and are less protected when these ties fragment. Previous research on loneliness, suggests that the negative impacts of social isolation are more profound for males than females [42] and marital quality plays a crucial role [23] [43]. Fourth, life limiting and long-term illness is associated with depression (co-morbid and subthreshold) but not for those with anxiety alone. Importantly, males across the anxiety and depression disorders, are more likely to have alcohol problems and smoke.

The benefits of good mental health include the ability to form and maintain relationships, and to participate in social and economic activity. With an increasingly aging population, maintaining full mental and physical health is important in itself but significant also for healthcare systems and the economy, generally. Depression in older age is typically associated with loss, and sometimes, multiple and interconnected losses (e.g. health and mobility, social networks and significant others through bereavement). The relationship, often bi-directional, between loneliness and depression is difficult to disentangle [35].

Our findings suggest that anxiety appears to have a distinctly different relationship to loneliness, appearing not to influence social connections and functioning in the same way as depression. This association may simply be artefactual of this group being relatively unaffected by the life-limiting health problems, so strongly associated with loneliness among the depressed sub-groups. Moreover, this study is unable to show the interrelationship between the sub-groups. For example, does membership of the anxiety only group predict later depression? Previous studies suggest that anxiety tends to be future-oriented whereas depression is past-oriented but also that there are dynamic interactions between anxious and depressed mood [44] [45].

Depression in adolescent (ages 14–25 years) females is double that of males, a ratio that decreases with age [46]. However, after 65 years, there is a reduction in depression rates for both males and females with a trend towards convergence. Nevertheless, while males and females share various determinants of psychological disorders, they also diverge in several dimensions. Thus, while marriage is generally protective, it may also produce strain for some and differentially experienced by males and females [47]. Additionally, the transition to older age and consequent changes to role and status may have different socio-cultural and psychological implications for men and females. Thus, the end of child-rearing and the beginning of retirement may impact differently for males and females [48]. Post- retirement, females tend to have cultivated stronger, non-employment related networks compared to males. Consequently, it may be posited that socio-cultural differences related to role and status may have distinct loci within depression and anxiety symptoms.

Conclusion and Implications for GP's clinical practice

Our study notes a high prevalence of mental-ill health among this older population, highlighting the importance of appropriate diagnosis and treatment as a priority. Depression and anxiety are the most common mental disorders in primary care, consuming much of GPs' workloads. There is a need therefore, for a more nuanced understanding of risk factors to assist early detection. As people age there is a general pathway from transmissible disease to more chronic conditions, including mental-ill health. Consequently, among the older population, general practice appointments provide a good opportunity to screen for mental-ill health and provide timely intervention. Our findings confirm that demographic and contextual factors are associated with patterns of mental-ill health, these implications should be given careful consideration when tailoring the most appropriate service delivery. In Ireland, Mental health policy advocates a holistic, multidisciplinary approach to improving mental health outcomes, under the governance of 'A Vision for Change' [49]. This policy stresses the importance of treating mental disorders in the community, our findings further emphasise the importance for GP's to utilise opportunities for social prescribing. Finally, our findings have clinical and diagnostic significance, suggesting that anxiety and depression are not distinct conditions and are strongly associated with loneliness. More attention should be paid to the mental health needs of people with long term health problems who appear to be particularly at risk of loneliness.

Strengths and limitations

While the study highlights concern around social isolation among older people living with anxiety and depression and its consequences, the study cannot address issues of precedence - whether anxiety precedes a depressed mood or not, functioning as a precipitating chronic stressor of depression.

The CES-D and HADS-A are useful as initial screening tools to identify participants who need further in-depth assessment of their depressive or anxious symptoms. However, it must be noted that they are not stand-alone diagnostic tools. In a clinical setting it is recommended that additional diagnostic evaluations are required for all participants with scores greater than the specified cut off points. Specifically, follow-up diagnostic evaluations are needed to confirm a diagnosis and also to

distinguish depressive disorders and anxiety disorders. In light of these limitations, information from the CES-D and HADS-A is adequate in allowing us to profile this population and identify risk factors for poorer mental ill health, which is beneficial for informing tailored community level interventions for this population. Anxiety often precedes depression in response to stressors, and identifying people with varying levels of depression will facilitate health practitioners to advise on early community intervention which will potentially reduce the burden in clinical settings.

Finally, this study furthers our understanding of the co-occurrence of anxious and depressed mood. Planned revisions of the DSM may significantly alter how such comorbidities are reconceptualised (including at subthreshold level where symptoms may be reshaped to form a single disorder). Given this, further analyses focussing on the age sensitive epidemiology of symptoms for common mental disorders are warranted.

References

1 Wolitzky-Taylor KB, Castriotta N, Lenze EJ, Stanley MA, Craske MG. Anxiety disorders in older adults: a comprehensive review. *Depress.Anxiety* 2010; **27**: 190-211.

2 Craske MG. Transdiagnostic treatment for anxiety and depression. *Depress.Anxiety* 2012; **29**: 749-53.

3 Maier W, Gänsicke M, Freyberger H, Linz M, Heun R, Lecrubier Y. Generalized anxiety disorder [ICD-10] in primary care from a cross-cultural perspective: a valid diagnostic entity?. *Acta Psychiatr.Scand.* 2000; **101**: 29-36.

4 Cairney J, Corna LM, Veldhuizen S, Herrmann N, Streiner DL. Comorbid depression and anxiety in later life: patterns of association, subjective well-being, and impairment. *The American journal of geriatric psychiatry* 2008; **16**: 201-8.

5 Ayers CR, Sorrell JT, Thorp SR, Wetherell JL. Evidence-based psychological treatments for late-life anxiety. *Psychol.Aging* 2007; **22**: 8.

6 Lenze EJ, Wetherell JL. Bringing the bedside to the bench, and then to the community: a prospectus for intervention research in late-life anxiety disorders. *International Journal of Geriatric Psychiatry: A journal of the psychiatry of late life and allied sciences* 2009; **24**: 1-14.

7 Lenze EJ, Wetherell JL. A lifespan view of anxiety disorders. *Dialogues Clin.Neurosci.* 2011; **13**: 381-99.

8 Blay SL, Marinho V. Anxiety disorders in old age. *Current Opinion in Psychiatry* 2012; **25**: 462-7.

9 Vink D, Aartsen MJ, Schoevers RA. Risk factors for anxiety and depression in the elderly: a review. *J.Affect.Disord.* 2008; **106**: 29-44.

10 Tiller JW. Depression and anxiety. *Med.J.Aust.* 2013; **199**: 28-31.

11 Wittchen H, Beesdo K, Bittner A, Goodwin RD. Depressive episodes–evidence for a causal role of primary anxiety disorders?. *European Psychiatry* 2003; **18**: 384-93.

12 Moitra E, Herbert JD, Forman EM. Behavioral avoidance mediates the relationship between anxiety and depressive symptoms among social anxiety disorder patients. *J.Anxiety Disord.* 2008; **22**: 1205-13.

13 Harrington J, Perry IJ, Lutomski J, Fitzgerald AP, Shiely F, McGee H, Barry MM, Van Lente E, Morgan K, Shelley E. Living longer and feeling better: healthy lifestyle, self-rated health, obesity and depression in Ireland. *Eur.J.Public Health* 2009; **20**: 91-5.

14 Beekman AT, de Beurs E, van Balkom AJ, Deeg DJ, van Dyck R, van Tilburg W. Anxiety and depression in later life: co-occurrence and communality of risk factors. *Am.J.Psychiatry* 2000; **157**: 89-95.

15 Schaub RT, Linden M. Anxiety and anxiety disorders in the old and very old—results from the Berlin Aging Study [BASE]. *Compr.Psychiatry* 2000; **41**: 48-54.

16 Porensky EK, Dew MA, Karp JF, Skidmore E, Rollman BL, Shear MK, Lenze EJ. The burden of late-life generalized anxiety disorder: effects on disability, health-related quality of life, and healthcare utilization. *The American Journal of Geriatric Psychiatry* 2009; **17**: 473-82.

17 Lenze EJ, Mulsant BH, Shear MK, Alexopoulos GS, Frank E, Reynolds CF. Comorbidity of depression and anxiety disorders in later life. *Depress.Anxiety* 2001; **14**: 86-93.

18 Möller H, Bandelow B, Volz H, Barnikol UB, Seifritz E, Kasper S. The relevance of 'mixed anxiety and depression'as a diagnostic category in clinical practice. *Eur.Arch.Psychiatry Clin.Neurosci.* 2016; **266**: 725-36.

19 Dunlop BW, Scheinberg K, Dunlop AL. Ten ways to improve the treatment of depression and anxiety in adults. *Ment.Health.Fam.Med.* 2013; **10**: 175-81.

20 Singleton N, Bumpstead R, O'Brien M, Lee A, Meltzer H. Psychiatric morbidity among adults living in private households, 2000. *International Review of Psychiatry* 2003; **15**: 65-73.

21 Bryant C, Jackson H, Ames D. Depression and anxiety in medically unwell older adults: prevalence and short-term course. *International Psychogeriatrics* 2009; **21**: 754-63.

22 García-Peña C, Wagner FA, Sánchez-García S, Espinel-Bermúdez C, Juárez-Cedillo T, Pérez-Zepeda M, Arango-Lopera V, Franco-Marina F, Ramírez-Aldana R, Gallo JJ. Late-life depressive symptoms: prediction models of change. *J.Affect.Disord.* 2013; **150**: 886-94.

23 Victor CR, Bowling A. A longitudinal analysis of loneliness among older people in Great Britain. *J.Psychol.* 2012; **146**: 313-31.

24 Ayalon L, Shiovitz-Ezra S, Palgi Y. Associations of loneliness in older married men and women. *Aging & Mental Health* 2013; **17**: 33-9.

25 Perissinotto CM, Cenzer IS, Covinsky KE. Loneliness in older persons: a predictor of functional decline and death. *Arch.Intern.Med.* 2012; **172**: 1078-84.

26 Jaremka LM, Fagundes CP, Glaser R, Bennett JM, Malarkey WB, Kiecolt-Glaser JK. Loneliness predicts pain, depression, and fatigue: understanding the role of immune dysregulation. *Psychoneuroendocrinology* 2013; **38**: 1310-7.

27 Lauder W, Mummery K, Jones M, Caperchione C. A comparison of health behaviours in lonely and non-lonely populations. *Psychol., Health Med.* 2006; **11**: 233-45.

28 Holt-Lunstad J, Smith TB, Baker M, Harris T, Stephenson D. Loneliness and social isolation as risk factors for mortality: a meta-analytic review. *Perspectives on Psychological Science* 2015; **10**: 227-37.

29 Pantell M. 1. Dangers of loneliness–Case of the Elderly Hypertensive. *Am.J.Public Health* 2013; **103**: 2056-62.

30 Usta YY. Importance of social support in cancer patients. *Asian Pacific Journal of Cancer Prevention* 2012; **13**: 3569-72.

31 Adams KB, Roberts AR, Cole MB. Changes in activity and interest in the third and fourth age: Associations with health, functioning and depressive symptoms. *Occupational Therapy International* 2011; **18**: 4-17.

32 Berkman LF, Glass T, Brissette I, Seeman TE. From social integration to health: Durkheim in the new millennium. *Soc.Sci.Med.* 2000; **51**: 843-57.

33 Kearney PM, Cronin H, O'regan C, Kamiya Y, Savva GM, Whelan B, Kenny R. Cohort profile: the Irish longitudinal study on ageing. *Int.J.Epidemiol.* 2011; **40**: 877-84.

34 Kenny RA, Whelan BJ, Cronin H, Kamiya Y, Kearney P, O'Regan C, Ziegel M. The design of the Irish longitudinal study on ageing 2010;.

35 Kitchens JM. Does this patient have an alcohol problem?. *JAMA* 1994; **272**: 1782-7.

36 Radloff LS. The CES-D scale: A self-report depression scale for research in the general population. *Applied psychological measurement* 1977; **1**: 385-401.

37 Lewinsohn PM, Seeley JR, Roberts RE, Allen NB. Center for Epidemiologic Studies Depression Scale [CES-D] as a screening instrument for depression among community-residing older adults. *Psychol.Aging* 1997; **12**: 277.

38 Olssøn I, Mykletun A, Dahl AA. The Hospital Anxiety and Depression Rating Scale: a cross-sectional study of psychometrics and case finding abilities in general practice. *BMC Psychiatry* 2005; **5**: 46.

39 Hawkley LC, Kocherginsky M. Transitions in loneliness among older adults: A 5-year follow-up in the National Social Life, Health, and Aging Project. *Res.Aging* 2018; **40**: 365-87.

40 Aartsen M, Jylhä M. Onset of loneliness in older adults: results of a 28 year prospective study. *European journal of ageing* 2011; **8**: 31-8.

41 Nicolaisen M, Thorsen K. Who are lonely? Loneliness in different age groups [18–81 years old], using two measures of loneliness. *The International Journal of Aging and Human Development* 2014; **78**: 229-57.

42 Cacioppo S, Balogh S, Cacioppo JT. Implicit attention to negative social, in contrast to nonsocial, words in the Stroop task differs between individuals high and low in loneliness: evidence from event-related brain microstates. *Cortex* 2015; **70**: 213-33.

43 Warner DF, Kelley-Moore J. The social context of disablement among older adults: Does marital quality matter for loneliness?. *J.Health Soc.Behav.* 2012; **53**: 50-66.

44 Starr LR, Davila J. Temporal patterns of anxious and depressed mood in generalized anxiety disorder: A daily diary study. *Behav.Res.Ther.* 2012; **50**: 131-41.

45 Starr LR, Davila J. Cognitive and interpersonal moderators of daily co-occurrence of anxious and depressed moods in generalized anxiety disorder. *Cognitive therapy and research* 2012; **36**: 655-69.

46 Bebbington P, Dunn G, Jenkins R, Lewis G, Brugha T, Farrell M, Meltzer H. The influence of age and sex on the prevalence of depressive conditions: report from the National Survey of Psychiatric Morbidity. International Review of Psychiatry 2003; 15: 74-83.

47 Hammen C. Stress and depression. Annu.Rev.Clin.Psychol. 2005; 1: 293-319.

48 Domènech-Abella J, Mundó J, Haro JM, Rubio-Valera M. Anxiety, depression, loneliness and social network in the elderly: Longitudinal associations from The Irish Longitudinal Study on Ageing [TILDA]. J.Affect.Disord. 2019; 246: 82-8.

49 Government of Ireland. A vision for change: Report of the expert group on mental health policy. 2006.

Table 1: Frequency of depressive or anxiety symptoms and percentages within gender as measured in the anxiety [HADS-A] and depression [CES-D], reported in the Computer Assisted Personal Interview [CAPI].

Depression and anxiety symptoms listed in the CES-D and HADS-A	Total sample 8,504 [%]	Males 3780 [44.4%]	Females 4724 [55.6%]
Questions from the depression subscale			
Bothered by things that usually don't bother me	1718 [20.2]	635 [16.8]	1083 [23.1]
I did not feel like eating	1003 [11.8]	352 [9.3]	651 [13.8]
I could not shake off the blues even with help	1137 [13.4]	397 [10.5]	740 [15.7]
I felt that I was not as good as other people	670 [7.9]	327 [10.5]	347 [7.4]
Trouble keeping my mind on what I was doing	2238 [26.3]	854 [22.6]	1384 [29.3]
I felt depressed	1536 [18.1]	567 [15.0]	969 [20.5]
I felt that everything I did was an effort	1769 [20.8]	665 [17.6]	1104 [23.4]
I did not feel hopeful about the future	716 [8.4]	337 [9.0]	379 [8.1]
I thought my life had been a failure	761 [8.9]	318 [8.4]	443 [9.4]
I felt fearful	1293 [15.2]	402 [10.6]	891 [18.9]
My sleep was restless	3420 [40.2]	1228 [32.5]	2192 [46.5]
I was not happy	393 [4.6]	172 [4.6]	221 [4.7]
I talked less than usual	1305 [15.3]	544 [14.4]	761 [16.1]
I felt lonely	1599 [18.8]	524 [13.9]	1075 [22.8]
People were unfriendly	738 [8.7]	332 [8.8]	406 [8.6]
I did not enjoy life	365 [4.3]	141 [3.7]	224 [4.7]
I had crying spells	961 [11.3]	207 [5.5]	754 [16.0]
I felt sad	2236 [26.3]	794 [21.0]	1442 [30.6]
I felt that people disliked me	549 [6.5]	213 [5.6]	336 [7.1]
I could not get 'going'	1660 [19.5]	607 [16.1]	1053 [22.3]
Questions from the anxiety subscale			
I feel tense or wound up	5662 [66.6]	1693 [99.2]	3334 [85.2]
Frightened feeling something awful about to happen	3877 [45.6]	1548 [49.6]	2329 [59.6]
Worrying thoughts	4329 [50.9]	1765 [56.7]	2564 [65.5]
I do not sit at ease and feel relaxed	83 [1.0]	27 [0.9]	56 [1.4]
Frightened feeling like 'butterflies' in the stomach	3958 [55.9]	1464 [46.6]	2494 [63.4]
I feel restless as if I have to be on the move	4963 [58.4]	2172 [69.1]	2791 [70.8]
I get sudden feelings of panic	3127 [36.8]	1209 [38.4]	1918 [48.7]

Depressive symptoms were assessed by the 20-item Centre for Epidemiologic Studies - Depression [CES-D] [Radloff, 1977] which assesses symptoms experienced in the seven days preceding the survey.

Anxiety symptoms were assessed with the anxiety subscale of the Hospital Anxiety and Depression Scale [HADS-A] [Zigmond & Snaith, 1983], which measures the presence of anxiety symptoms with no specific time frame.

Table 2: Fit indices of the LCA to profile depression and anxiety symptoms in males and females

Model	Log	Free	AIC	BIC	SSABIC	LRT	ρ	Entropy
1 Class males	-39946	27	79946	80114	80029			
2 Class males	-34871	55	69853	70196	70022	10104	0·00	0.89
3 Class males	-33558	83	67282	67800	67536	2615	0.00	0.79
4 Class males	**-33008**	**111**	**66239**	**66932**	**66579**	**1093**	**0·00**	**0.77**
5 Class males	-32676	139	65631	66498	66056	661	0·00	0.75
6 Class males	-32522	167	65378	66419	65889	308	0.31	0.77
1 Class females	-55941	27	111936	112111	112025			
2 Class females	-48270	55	96651	97006	96831	15277	0.00	0.91
3 Class females	-46761	83	93689	94225	93962	3004	0.00	0.79
4 Class females	**-45902**	**111**	**92027**	**92745**	**92392**	**1710**	**0.00**	**0.78**
5 Class females	-45485	139	91248	92146	91705	831	0.00	0.72
6 Class females	-45288	167	90911	91990	91459	391	0.08	0.75

Log= log likelihood function, maximum likelihood estimation. Free= free parameters, LRX2= likelihood ratio chi-square. AIC= Akaike information criteria. BIC= Bayesian information criteria. SSABIC= Sample size adjusted BIC. LRT= Lo-Mendell-Rubin adjusted likelihood ratio test.

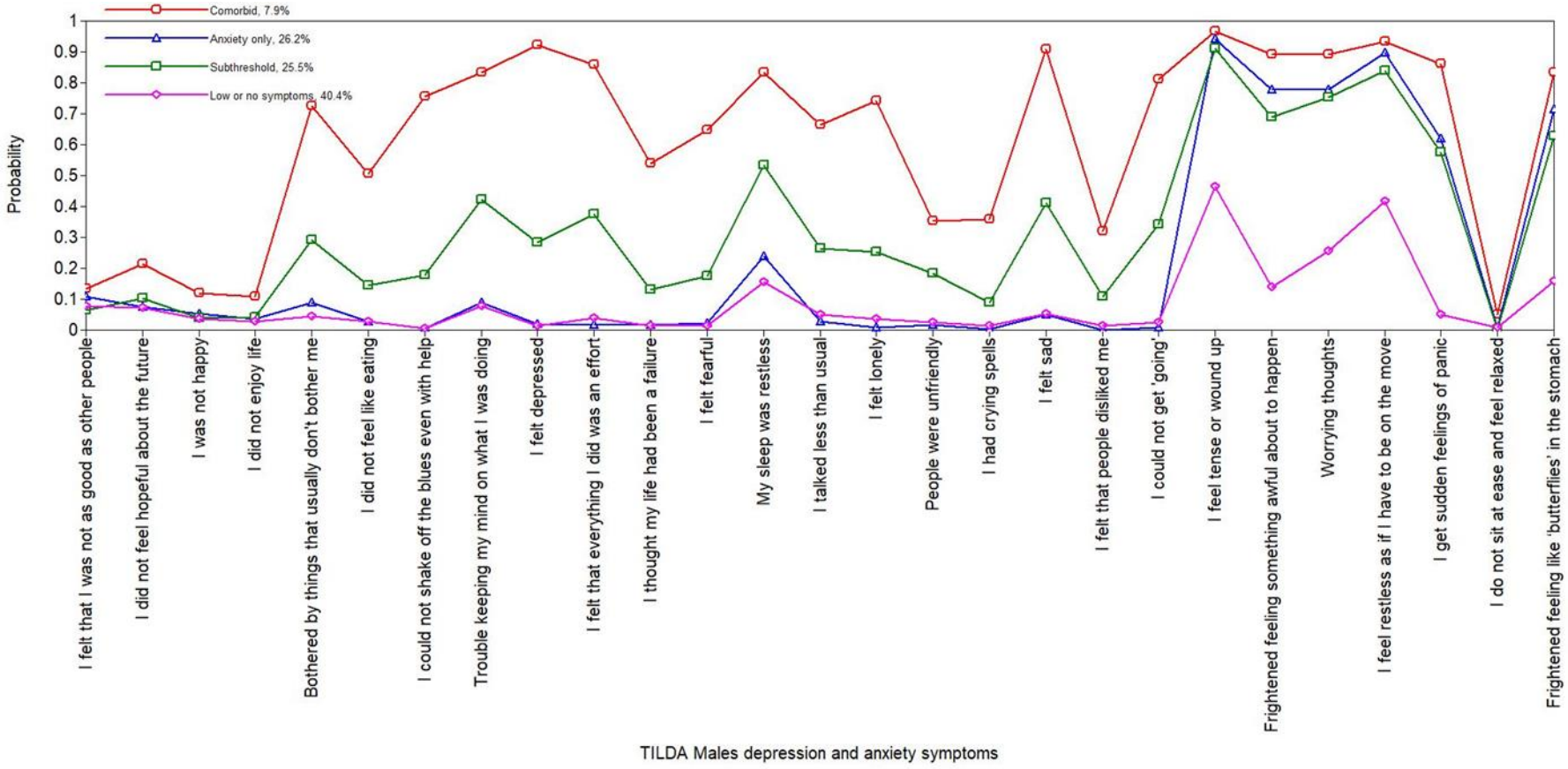

Figure 1: The four-class solution [males] this comprises: [1] *comorbid depression and anxiety* [7.9% of the sample], with a high probability of reporting symptoms of both depression and anxiety [2] *anxiety only* [26.2.3%], scoring high on the probability for experiencing anxiety symptoms; [3] *anxiety and subthreshold depression* [25.5%]; and [4] *no or low depression and anxiety* symptoms [40.4%].

Table 3		Comorbid depression and anxiety		Subthreshold depression		Anxiety only	
Male LCA groups and Regression models for social and health indicators		**M1**	**M2**	**M3**	**M4**	**M5**	**M6**
Age at interview	50-59	1.00	1.00	1.00	1.00	1.00	1.00
	60-69	**0.62 [0.43, 0.88]**	**0.63 [0.43, 0.93]**	0.91 [0.74, 1.11]	0.94 [0.76, 1.16]	**0.80 [0.66, 0.97]**	**0.78 [0.64, 0.94]**
	70-79	**0.37 [0.22, 0.62]**	**0.38 [0.22, 0.65]**	0.91 [0.72, 1.16]	1.05 [0.82, 1.34]	**0.74 [0.58, 0.94]**	**0.69 [0.53, 0.90]**
	80+	**0.12 [0.05, 0.31]**	**0.15 [0.05, 0.39]**	**0.66 [0.47, 0.93]**	0.82 [0.57, 1.18]	**0.54 [0.36, 0.81]**	**0.49 [0.32, 0.75]**
Education	Primary school level	1.00	1.00	1.00	1.00	1.00	1.00
	Secondary level	0.85 [0.60, 1.19]	0.92 [0.65, 1.32]	0.91 [0.75, 1.09]	0.89 [0.73, 1.09]	**0.76 [0.64, 0.91]**	**0.76 [0.63, 0.91]**
	Tertiary [Degree or Higher]	0.82 [0.50, 1.34]	0.81 [0.48, 1.36]	**1.37 [1.09, 1.73]**	**1.31 [1.03, 1.67]**	0.95 [0.74, 1.23]	0.92 [0.70, 1.20]
Spouse support	Scale 0-4	1.03 [0.98, 1.08]	1.03 [0.98, 1.08]	**1.04 [1.01, 1.06]**	1.03 [1.00, 1.05]	**1.08 [1.05, 1.11]**	**1.07 [1.04, 1.10]**
Relationship strain	Scale 0-4	**1.08 [1.03, 1.14]**	**1.07 [1.01, 1.12]**	**1.07 [1.04, 1.10]**	**1.05 [1.02, 1.08]**	**1.07 [1.04, 1.11]**	**1.07 [1.04, 1.10]**
Social network	Scale 0-4	**0.64 [0.53, 0.78]**	**0.69 [0.56, 0.85]**	0.90 [0.81, 1.00]	0.99 [0.89, 1.10]	1.00 [0.90, 1.11]	1.06 [0.94, 1.18]
Perceived loneliness	Not lonely	1.00	1.00	1.00	1.00	1.00	1.00
	Sometimes	**11.35 [7.91, 16.28]**	**10.58 [7.23, 15.48]**	**1.96 [1.55, 2.47]**	**1.87 [1.47, 2.37]**	**0.01 [0.00, 0.08]**	**0.01 [0.00, 0.08]**
	Most of the time	**16.83 [10.75, 26.34]**	**14.59 [8.98, 23.71]**	**1.57 [1.12, 2.21]**	1.40 [0.98, 2.00]	**0.05 [0.01, 0.19]**	**0.05 [0.01, 0.19]**
	All of the time	**16.13 [8.97, 29.00]**	**12.09 [6.33, 23.09]**	0.78 [0.41, 1.47]	0.71 [0.36, 1.38]	**0.09 [0.02, 0.43]**	**0.10 [0.02, 0.46]**
Difficulty holding a conversation	Not at all	1.00	1.00	1.00	1.00	1.00	1.00
	Sometimes	**1.97 [1.41, 2.75]**	**1.66 [1.15, 2.38]**	**1.97 [1.62, 2.39]**	**1.88 [1.54, 2.30]**	**1.23 [1.01, 1.50]**	1.16 [0.94, 1.42]
	Most of the time	**2.58 [1.54, 4.32]**	**1.76 [1.02, 3.02]**	**2.01 [1.45, 2.77]**	**1.83 [1.31, 2.55]**	1.33 [0.88, 1.99]	1.18 [0.76, 1.83]
Smoking status	No		1.00		1.00		1.00
	Past		1.15 [0.81, 1.62]		**1.54 [1.27, 1.87]**		**1.59 [1.35, 1.89]**
	Current		0.91 [0.58, 1.42]		**1.40 [1.08, 1.81]**		1.22 [0.95, 1.59]
Medication for Hypertension	No		1.00		1.00		1.00
	Yes		1.23 [0.87, 1.73]		0.93 [0.78, 1.11]		**1.37 [1.13, 1.66]**
CAGE alcohol scale	Scale 0-4		**1.34 [1.17, 1.54]**		**1.38 [1.28, 1.50]**		**1.25 [1.14, 1.36]**
Health	No illness		1.00		1.00		1.00
	Long-term illness		0.91 [0.55, 1.51]		1.10 [0.87, 1.41]		**0.77 [0.60, 0.99]**
	Limiting long-term illness		**2.44 [1.75, 3.41]**		**1.35 [1.11, 1.64]**		0.86 [0.69, 1.07]

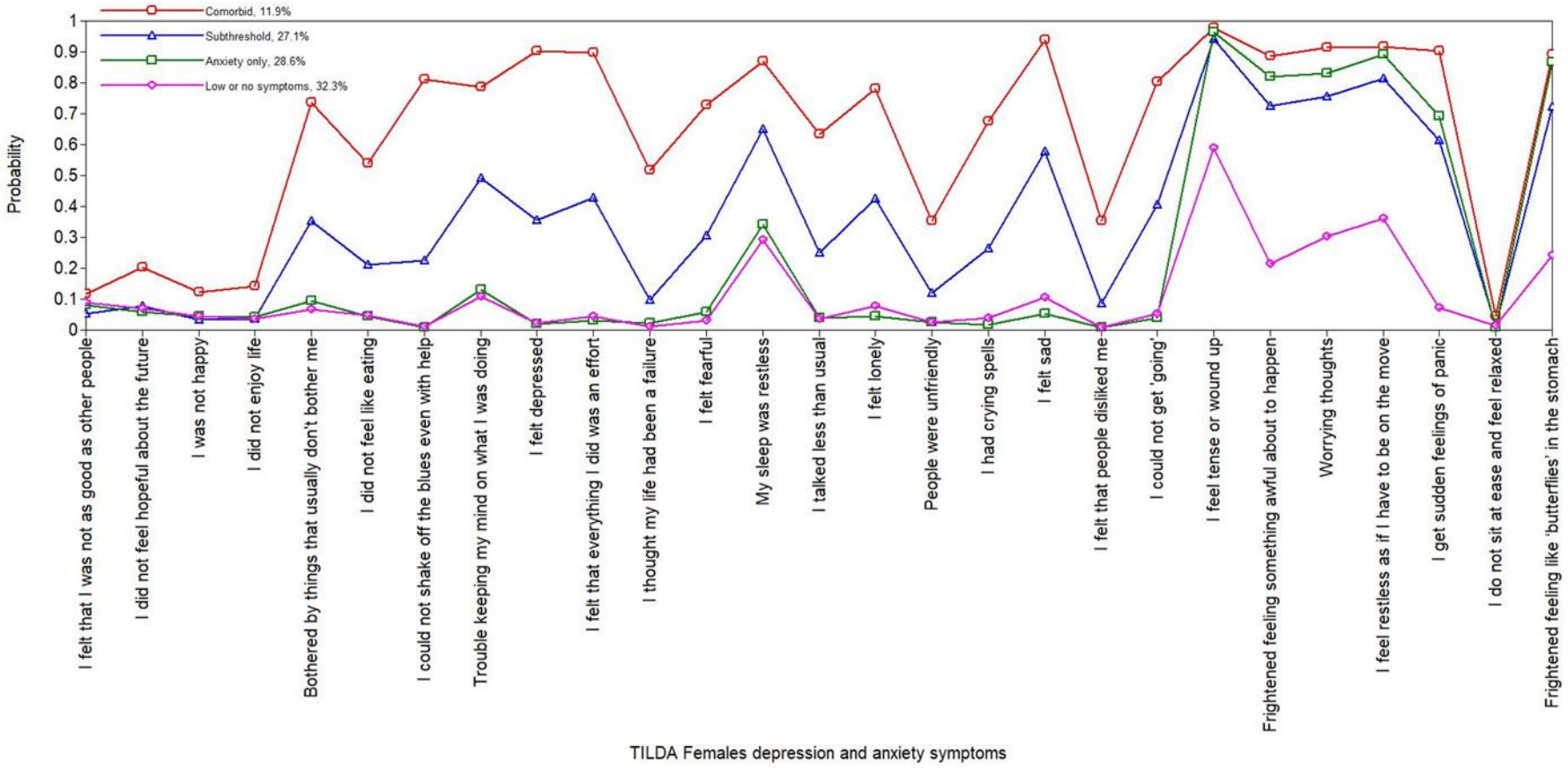

Figure 2: The four-class solution [females] – this comprises: [1] *comorbid depression and anxiety* [11.9% of the sample], with a high probability of reporting symptoms of depression and anxiety [2] *anxiety and subthreshold depression* [27.1%]; [3] *anxiety only* [28.6%], scoring high on the probability for experiencing anxiety symptoms; and [4] *no or low depression and anxiety* symptoms [32.3%].

Table 4		Comorbid depression and anxiety		Subthreshold depression		Anxiety only	
Female LCA groups and Regression models for social and health indicators		**M1**	**M2**	**M3**	**M4**	**M5**	**M6**
Age at interview	50-59	1.00	1.00	1.00	1.00	1.00	1.00
	60-69	**0.64 [0.48, 0.86]**	**0.69 [0.50, 0.93]**	0.97 [0.81, 1.16]	0.92 [0.77, 1.10]	0.94 [0.81, 1.11]	0.93 [0.79, 1.10]
	70-79	**0.48 [0.32, 0.72]**	**0.51 [0.33, 0.79]**	1.20 [0.98, 1.48]	1.07 [0.87, 1.32]	**0.77 [0.63, 0.94]**	**0.74 [0.59, 0.92]**
	80+	**0.35 [0.19, 0.63]**	**0.40 [0.20, 0.78]**	1.27 [0.96, 1.67]	1.07 [0.79, 1.44]	0.82 [0.58, 1.17]	0.81 [0.56, 1.18]
Education	Primary school level	1.00	1.00	1.00		1.00	
	Secondary level	**0.66 [0.51, 0.86]**	**0.73 [0.56, 0.96]**	**1.31 [1.09, 1.58]**	**1.35 [1.12, 1.63]**	**1.33 [1.12, 1.59]**	**1.36 [1.13, 1.64]**
	Tertiary [Degree or Higher]	**0.36 [0.23, 0.55]**	**0.45 [0.29, 0.70]**	0.93 [0.73, 1.19]	1.01 [0.78, 1.29]	1.01 [0.79, 1.28]	1.08 [0.85, 1.39]
Spouse support	Scale 0-4	0.97 [0.93, 1.01]	0.96 [0.92, 1.01]	**0.94 [0.91, 0.96]**	**0.94 [0.92, 0.96]**	**0.93 [0.91, 0.95]**	**0.93 [0.91, 0.95]**
Relationship strain	Scale 0-4	**1.13 [1.08, 1.18]**	**1.13 [1.08, 1.19]**	1.03 [1.00, 1.06]	1.04 [1.00, 1.07]	**1.05 [1.02, 1.08]**	**1.06 [1.03, 1.08]**
Social network	Scale 0-4	0.92 [0.77, 1.10]	1.00 [0.83, 1.21]	1.06 [0.95, 1.17]	1.01 [0.91, 1.12]	**1.20 [1.10, 1.31]**	**1.16 [1.05, 1.27]**
Perceived loneliness	Not lonely	1.00	1.00	1.00	1.00	1.00	1.00
	Sometimes	**13.57 [9.71, 18.95]**	**12.05 [8.50, 17.07]**	**4.40 [3.65, 5.29]**	**4.56 [3.77, 5.51]**	**0.18 [0.12, 0.26]**	**0.17 [0.12, 0.26]**
	Most of the time	**19.54 [13.42, 28.43]**	**16.37 [11.04, 24.27]**	**3.14 [2.36, 4.18]**	**3.09 [2.31, 4.15]**	**0.15 [0.08, 0.27]**	**0.16 [0.09, 0.29]**
	All of the time	**55.49 [33.55, 91.77]**	**47.97 [27.77, 82.89]**	1.62 [0.99, 2.65]	**1.76 [1.07, 2.90]**	**0.06 [0.01, 0.27]**	**0.07 [0.02, 0.29]**
Difficulty holding a conversation	Not at all	1.00	1.00	1.00	1.00	1.00	1.00
	Sometimes	**0.66 [0.47, 0.92]**	**0.64 [0.45, 0.91]**	0.97 [0.80, 1.18]	0.99 [0.81, 1.21]	**0.63 [0.51, 0.77]**	**0.65 [0.53, 0.81]**
	Most of the time	1.21 [0.75, 1.95]	1.08 [0.64, 1.80]	1.06 [0.77, 1.45]	1.06 [0.77, 1.47]	**0.46 [0.29, 0.72]**	**0.49 [0.31, 0.78]**
Smoking status	No		1.00		1.00		1.00
	Past		0.75 [0.54, 1.05]		**0.83 [0.70, 0.99]**		**0.72 [0.61, 0.85]**
	Current		**1.77 [1.26, 2.48]**		0.92 [0.73 1.15]		1.01 [0.82, 1.25]
Medication for Hypertension	No		1.00		1.00		1.00
	Yes		0.85 [0.63, 1.15]		1.12 [0.95, 1.32]		0.96 [0.82, 1.13]
CAGE alcohol scale	Scale 0-4		0.95 [0.81, 1.11]		**0.80 [0.72, 0.88]**		**0.75 [0.68, 0.83]**
Health	No illness		1.00		1.00		1.00
	Long-term illness		1.32 [0.90, 1.95]		1.06 [0.86, 1.32]		1.07 [0.88, 1.30]
	Limiting long-term illness		**2.60 [1.91, 3.54]**		**1.22 [1.02, 1.46]**		0.91 [0.75, 1.10]